

# Incidence of Colorectal Carcinoma in the U.S.

## *An Update of Trends by Gender, Race, Age, Subsite, and Stage, 1975–1994*

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**BACKGROUND.** Colon carcinoma incidence rates have risen sharply over the second half of this century, particularly among males and blacks. In the late 1970s, incidence rates among whites began to decline for distant disease. Approximately 10 years later regional disease rates began to fall. The decline in incidence rates among whites largely has been attributed to more widespread colorectal carcinoma screening. However, similar trends by stage in blacks have not been observed.

**METHODS.** The incidence of colorectal carcinoma was evaluated by race, gender, age, and stage of disease for each subsite using data from > 220,000 cases diagnosed between 1975 and 1994 in the U. S. Surveillance, Epidemiology, and End Results program.

**RESULTS.** Recent data have continued to show a decrease in incidence rates of total colorectal carcinoma in whites since the mid-1980s, particularly for the distal colon and rectum. Overall, proximal colon carcinoma rates were higher than distal colon or rectal carcinoma rates throughout the study period. Proximal colon carcinoma rates in blacks were considerably higher than in whites and continued to increase, whereas rates in whites showed signs of declining. The age-specific and stage-specific trends for proximal colon carcinoma in blacks were not consistent with the possibility of earlier disease detection through screening.

**CONCLUSIONS.** Etiologic studies are necessary to understand the large increases in the incidence of proximal colon carcinoma among blacks. *Cancer* 1999;85:1670–6. © 1999 American Cancer Society.

**KEYWORDS:** colon carcinoma, rectal carcinoma, incidence, race, subsite, disease stage.

The incidence of colon carcinoma rose substantially in the second half of this century, more so among males than females.<sup>1,2</sup> Although the incidence rate among females initially was higher, the larger increase in the rate for males has led to a male predominance in the disease. Increases in incidence were most pronounced at older ages. In contrast, rectal carcinoma incidence rates were fairly stable.

Among whites, colorectal carcinoma incidence peaked in the 1980s and subsequently has declined.<sup>3</sup> Shifts in the stage- and subsite-specific incidence rates suggested the earlier detection of cancers through screening. Although localized and regional colorectal carcinoma rates continued to increase, distant stage disease remained stable until the late 1970s and then began to decline. Subsequent declines in localized and regional disease rates were noted by the late 1980s. Some variation in declines by subsite also was noted, with the largest decreases occurring in the rectum and distal colon, followed by the proximal colon.<sup>4</sup>

The rates for total colorectal carcinoma have shifted from an

excess among whites to an excess among blacks (in the late 1970s among women and in the late 1980s among men).<sup>5</sup> Blacks have not experienced the recent decline in incidence rates observed in whites. Trends by disease stage among blacks have not shown the emergence of patterns indicative of the earlier detection of colorectal carcinoma.<sup>4</sup> In addition, black/white rate ratios vary by subsite within the colorectum.<sup>6</sup> These observations suggested it would be fruitful to investigate the incidence patterns further to help discern the potential roles of screening and early detection versus etiologic factors.

The current study used U.S. population-based cancer registry data from the Surveillance, Epidemiology, and End Results (SEER) program for 1975-1994 to examine site-specific incidence rates by gender, race, age, and stage of disease. The current analyses extend the previous work of Chu et al.<sup>4</sup> by the inclusion of 3 additional years of data and more closely investigate the demographic patterns. In addition, the incidence rates are presented on a logarithmic rather than an arithmetic scale to identify proportional changes among population groups, as opposed to absolute changes in magnitude.<sup>7</sup> This type of presentation facilitates the comparison of rates of change and the development of etiologic hypotheses.

## MATERIALS AND METHODS

Data for this study were collected as part of the SEER program of the National Cancer Institute (NCI).<sup>5</sup> Since the early 1970s this program has been comprised of nine population-based cancer registries serving the states of Connecticut, Hawaii, Iowa, New Mexico, and Utah, and the greater San Francisco/Oakland (California), Detroit (Michigan), Seattle (Washington), and Atlanta (Georgia) metropolitan areas. Although not a statistical sample of the U. S., residents of these 9 geographic areas comprise approximately 10% of the entire U. S. population. Clinical and demographic data are obtained for all newly diagnosed cases among residents in these areas. The majority of cancer cases are identified from local hospital records, with additional case ascertainment from free-standing pathology laboratories, outpatient clinics, physicians' offices, and death certificates.

Primary invasive carcinomas of the colon or rectum diagnosed among whites and blacks between 1975 and 1994 were included in this analysis; lymphomas and appendiceal carcinomas were excluded. The subsites were defined using the 2nd edition of the *International Classification of Diseases for Oncology*.<sup>8</sup> The specific subsites were grouped because of small numbers of cases among blacks. Accordingly, the minimum number of cases on which a data point is based

is noted for blacks in the results section in parentheses. Three colorectal subsites were evaluated: the proximal colon (cecum, ascending colon, hepatic flexure, transverse colon, and splenic flexure), the distal colon (descending colon and sigmoid colon), and the rectum (rectosigmoid junction and rectum). The splenic flexure was included with the proximal colon because historically the transverse colon included both flexures, and because it is beyond the reach of the flexible sigmoidoscope.

The extent of disease at diagnosis included localized, regional, and distant disease. Localized disease was defined as tumor confined entirely to the colon or rectum. Regional disease was defined as tumor that extended beyond the limits of the colon or rectum directly into the surrounding tissue, organs, or regional lymph nodes. Distant disease was defined as tumor that had metastasized to other areas of the body.

Cases were classified by age, gender, race (white or black), and extent of disease. Trends for colorectal carcinoma subsites were evaluated for the time periods 1975-1978, 1979-1982, 1983-1986, 1987-1990, and 1991-1994. Incidence rates were computed using population estimates derived by the U. S. Bureau of the Census and the SEER Program, age-adjusted to the 1970 U. S. population using the direct method and 5-year age intervals, and plotted on a logarithmic scale. Rates for the age-specific analyses used age groups 45-64 years, 65-74 years, and 75+ years, and also were age-adjusted.

## RESULTS

A total of 203,295 colorectal carcinomas occurred between 1975 and 1994 among whites, and 17,093 occurred among blacks (Table 1). Colorectal carcinoma incidence rates were higher among males than females throughout the study period. Rates were higher among blacks than whites among females since the early 1980s and among males since the late 1980s. In whites, the overall incidence peaked in the mid-1980s and thereafter declined. In blacks, the overall incidence continued to rise in males and remained relatively constant in females.

### Trends by Subsite, Race, and Gender

The majority of tumors arose in the proximal colon (38.8%) and approximately equal numbers arose in the distal colon (29.6%) and rectum (28.5%). The incidence for all three subsites declined among whites (Fig. 1), more so for carcinoma of the rectal and distal colon than for carcinoma of the proximal colon. Among blacks, patterns for carcinoma of the rectum and distal colon were less clear, although rectal carci-

TABLE 1  
Incidence of Colorectal Carcinoma by Race and Gender between 1975 and 1994

	White men		White women		Black men		Black women	
	No.	Rate*	No.	Rate	No.	Rate	No.	Rate
1975-1978	17,516	56.6	18,394	42.8	1185	50.8	1303	42.4
1979-1982	19,350	58.8	20,239	43.4	1445	55.6	1584	44.9
1983-1986	21,406	61.4	21,735	43.7	1658	58.1	1857	46.4
1987-1990	21,756	59.0	21,168	40.0	1851	59.6	2032	45.9
1991-1994	21,148	53.9	20,583	36.9	2017	60.1	2161	44.8
1975-1994	101,176	57.9	102,119	41.2	8156	57.2	8937	44.9

\* Rate per 100,000 person-years, age-adjusted using the 1970 U. S. population as standard.

noma rates among females declined in the early 1990s. In contrast, proximal colon carcinoma incidence rates among blacks rose in both males (30% increase) and females (22.5% increase). The data point based on the fewest cases (292) occurred for rectal carcinoma among black females, and the majority of other data points were based on > 400 cases. Trends for cases with subsite unspecified (3.1%) were similar to patterns observed for total colorectal carcinomas by race and gender (data not shown).

Rectal carcinoma rates consistently have been higher among whites than blacks, although the differences have narrowed. Among males, rates of distal colon carcinoma were higher among whites than blacks until the last time period, whereas an excess among blacks had emerged among females by 1980. Proximal colon carcinoma rates in blacks exceeded those in whites over the entire study period.

#### Age Specific Trends by Subsite and Race

Within whites, the trends for each site were fairly consistent across age groups (Fig. 2). In contrast, the rise in proximal colon carcinoma observed among blacks, and the consequent discrepancy between rates of black and white proximal colon carcinoma, appeared most marked for the youngest age group (ages 45-64 years) (the minimum number of cases on which the data points are based was 160 for black females); among those age 75+ years, there were little racial differences in proximal colon carcinoma rates based on a minimum of 100 cases. The excess of rectal carcinoma among whites compared with blacks was most apparent at older ages, with little difference in individuals ages < 65 years.

#### Stage Specific Trends by Subsite, Race, and Gender

Overall, 36.5% of the total number of colorectal carcinomas were of localized stage, 37.2% were of regional

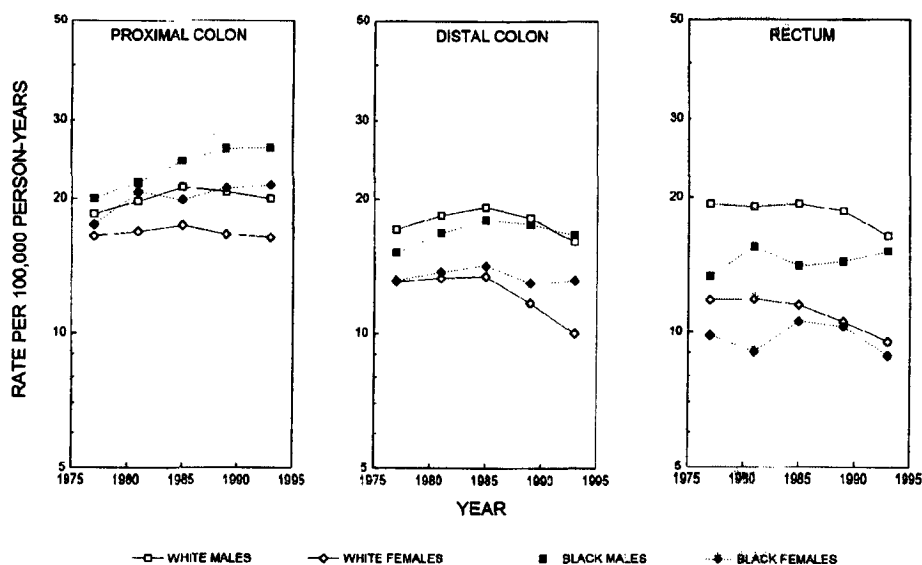
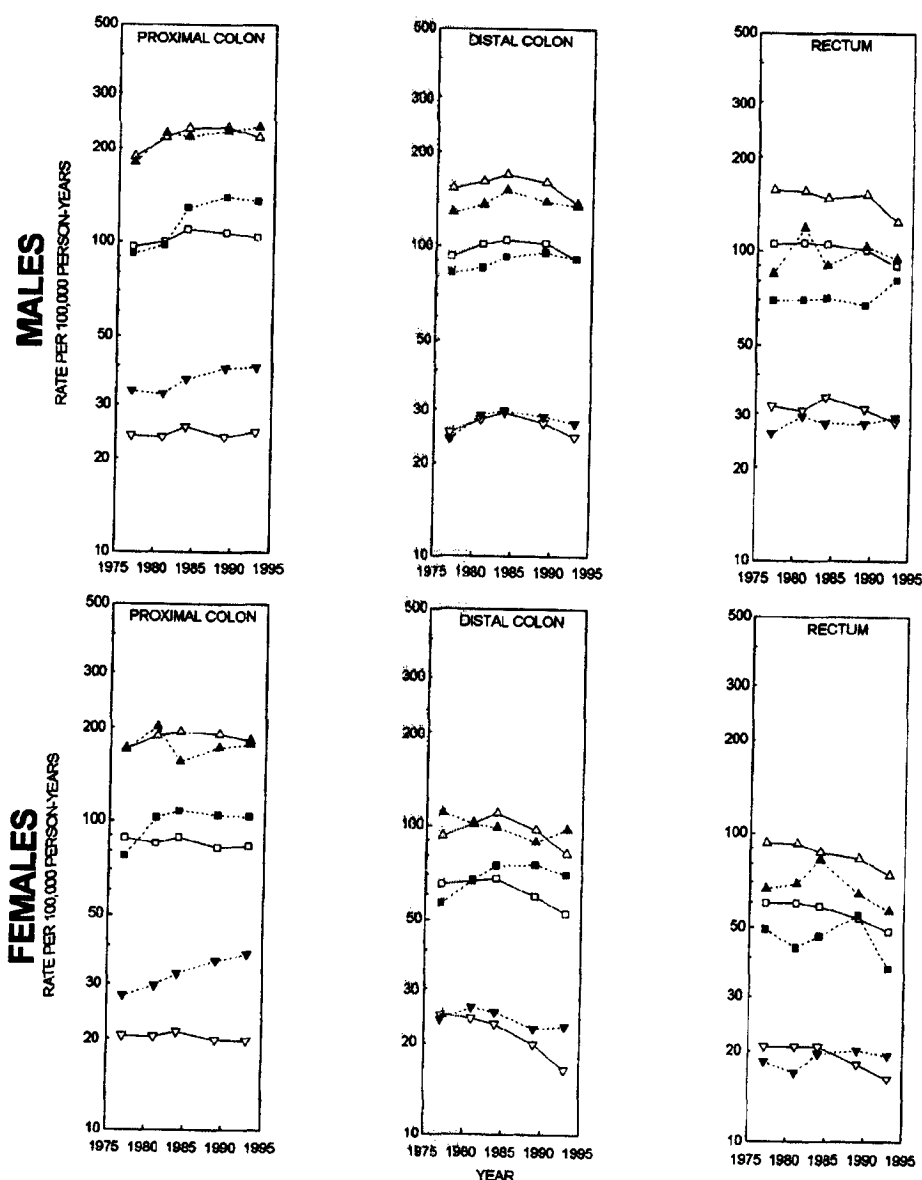


FIGURE 1. Age-adjusted (1970 standard) rates of colorectal carcinoma incidence in the nine Surveillance, Epidemiology, and End Results regions diagnosed between 1975-1978 and 1991-1994 by site, race, and gender. Open squares: white males; closed squares: black males; open diamonds: white females; closed diamonds: black females.



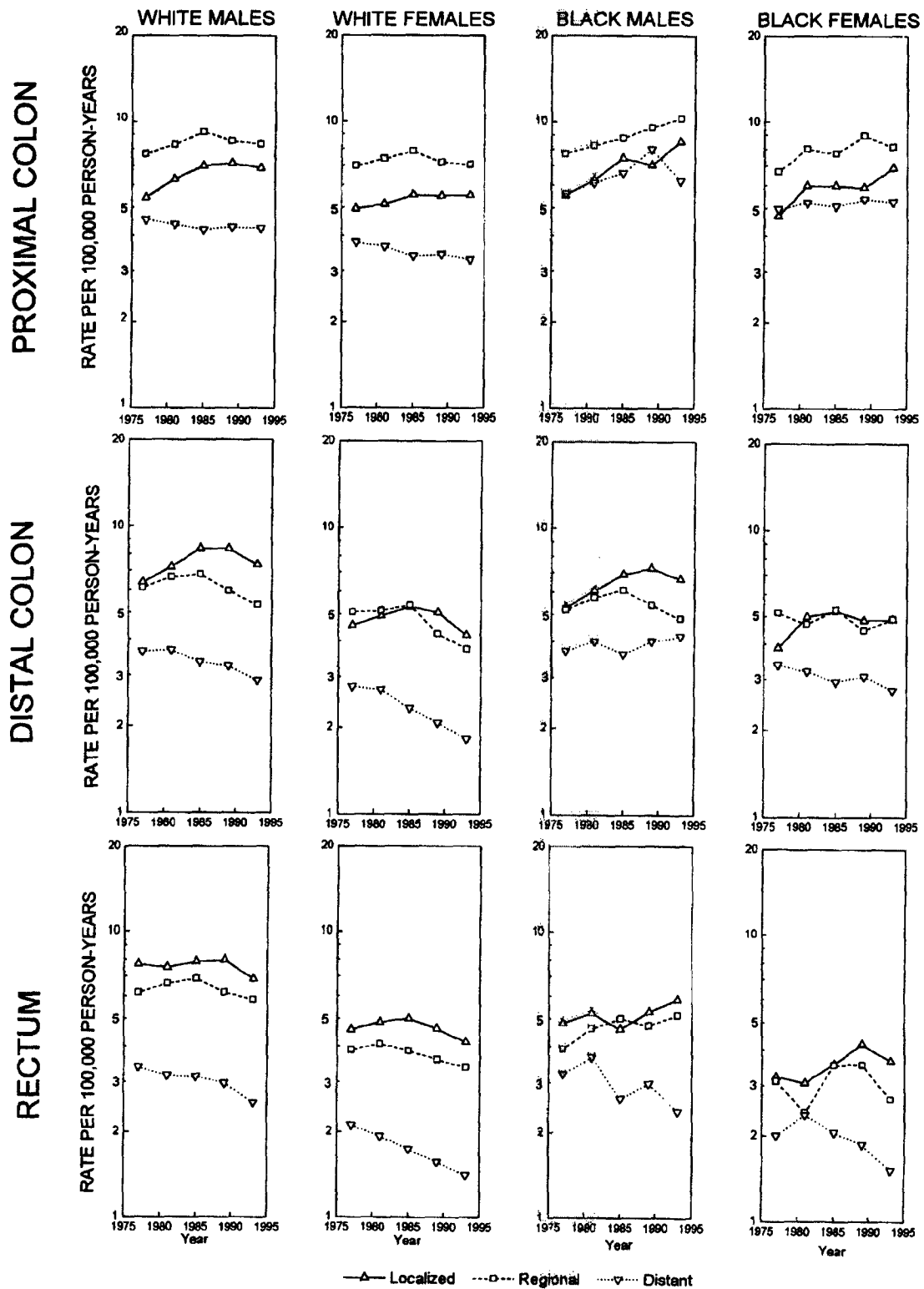
**FIGURE 2.** Age specific rates of colorectal carcinoma incidence in the nine Surveillance, Epidemiology, and End Results regions diagnosed between 1975–1978 and 1991–1994 by site, race, and gender. Open up arrow: whites ages 75+ years; closed up arrow: blacks ages 75+ years; open square: whites ages 65–74 years; closed square: blacks ages 65–74 years; open down arrow: whites ages 45–64 years; closed down arrow: blacks ages 45–64 years.

stage, and 19.5% were of distant stage at diagnosis. The most common stage of disease at diagnosis was localized for tumors of the distal colon and rectum, but was regional for tumors of the proximal colon. The least common stage was distant for all subsites. Stage was not specified for 6.8% of the total colorectal carcinoma cases. Cases with stage not specified were not included in the stage-specific analyses.

Distant disease rates among whites fell during the study period, most notably for the distal colon and rectum (Fig. 3). In general, regional disease rates peaked during the mid-1980s. Localized disease peaked in the mid- to late 1980s, although the subse-

quent decline was not as striking for the proximal colon.

Among blacks, rates for rectal carcinoma diagnosed as distant stage declined in both genders (minimum of 58 cases) (Fig. 3). Rates for regional and localized disease of the rectum in black females appeared to have decreased recently, but they continued to rise in black males (minimum of 87 cases). Rates of distal colon carcinoma diagnosed at a distant stage declined in black females during the study period, whereas rates were relatively stable in black males (minimum of 80 cases). Rates of distal colon regional disease in males and localized disease rates in both



**FIGURE 3.** Age-adjusted (1970 standard) stage-specific rates of colorectal carcinoma incidence in the nine Surveillance, Epidemiology, and End Results regions diagnosed between 1975–1978 and 1991–1994 by site, race, and gender. Open up arrow: localized disease; open square: regional disease; open down arrow: distant disease.

genders rose early in the study period but appeared to have decreased recently (minimum of 99 cases). Proximal colon carcinoma diagnosed at a distant stage appeared to have decreased only recently in black males and remained constant among black females (minimum of 80 cases). However, rates of regional and localized disease continued to increase for the proximal colon, more notably among males than females (minimum of 132 cases).

We explored further the increase in proximal colon carcinoma rates among blacks. Rates increased in the group ages 45-64 years for each stage (data not shown). Because blacks may have a higher proportion of mucinous tumors,<sup>9,10</sup> we examined proximal colon carcinoma rates by histology to determine whether the increases were explained by increases in the number of mucinous tumors but found similar increases for mucinous and nonmucinous tumors (data not shown).

## DISCUSSION

These data update the findings of Chu et al.<sup>4</sup> showing an overall decrease in the incidence rates of colorectal carcinoma in white males and females, and stage-specific shifts indicative of earlier detection, likely owing to screening. Among whites of both genders, decreasing incidence rates have continued in the most recently available data for the distal colon and rectum. Rates of proximal colon carcinoma in blacks are considerably higher than in whites and continue to increase, whereas rates in whites show signs of declining. Overall, proximal colon carcinoma rates were higher than rates for distal colon and rectal carcinoma throughout the study period.

The decline in incidence rates among whites has been attributed largely to more widespread colorectal carcinoma screening,<sup>3,4</sup> perhaps indicating an effect of intervention by the removal of premalignant adenomatous polyps. In blacks, stage-specific shifts in the incidence of rectal carcinoma clearly indicate the possibility of increased screening for this subsite. Distant disease of the rectum decreased in both black males and females, with corresponding increases in regional and localized disease suggesting a shift toward the earlier diagnosis of malignancies. Among females, these increases in localized and regional disease appeared to peak in the late 1980s. Chu et al.<sup>4</sup> cited data from the 1987 and 1992 National Health Interview Surveys that demonstrated an increase among blacks in the prevalence of the use of early detection procedures such as proctoscopy and fecal occult blood tests, although the use of these procedures still was much lower among blacks than whites. Data from the 1992 and 1993 Behavioral Risk Factor Surveillance Sys-

tem also indicated that the prevalence of proctosigmoidoscopy and digital rectal examination continued to be higher among whites than blacks.<sup>11</sup>

Unlike our observations for rectal carcinoma, proximal colon carcinoma rates in blacks continued to increase. Although distant disease appeared to be starting to decline in black men, possibly suggesting a screening effect, several other observations argued against the possibility that the increased prevalence of screening among blacks explains the increase in carcinoma of the proximal colon. First, in contrast to the patterns demonstrated for rectal carcinoma, the highest rates among black males and females were observed for regional rather than localized disease. In addition, increases were not noted exclusively among the very old; in fact, they were most pronounced among the youngest age group. Moreover, the most rapid increases in proximal colon carcinoma rates, occurring in black males and females ages 45-64 years, did not vary by stage of disease, although these results were based on a relatively small number of cases.

Alternatively, large increases in the rates of proximal colon carcinoma among blacks may be due to racial differences in environmental or life-style exposures. Because the estimated induction/latency period for colorectal carcinoma may be quite long, exposures occurring several decades in the past may be responsible for recent trends. Whether changes over time in the prevalence of factors that may contribute to or protect against colon carcinoma (including diet, use of nonsteroidal anti-inflammatory drugs, a sedentary life-style and its sequelae, and smoking) could explain the higher incidence among blacks for proximal colon carcinoma is not clear. Recent speculation regarding the possible role of hyperinsulinemia in the development of colon carcinoma<sup>12-14</sup> also is of interest because rates of noninsulin-dependent diabetes mellitus (NIDDM) among blacks are higher than among whites.<sup>15,16</sup> Moreover, rates of NIDDM among blacks have increased over the past 15-20 years, notably more so for males than females.<sup>15,16</sup> Whether hyperinsulinemia affects the proximal colon differentially is not known and warrants further study. Future epidemiologic studies should analyze these and other risk factors by subsite to determine whether any associations exist to explain the increase in proximal colon carcinoma among blacks.

In the interest of maintaining sufficient numbers of cases, SEER traditionally uses data from all nine geographic areas, although rates for blacks are published for only five of the geographic areas (San Francisco-Oakland; Connecticut; Metropolitan Detroit; Seattle-Puget Sound; and Metropolitan Atlanta), those

with the largest black populations. Geographic variation in colorectal carcinoma incidence and mortality exists, with much higher rates reported in the north compared with the south.<sup>5,17-20</sup> Because the racial composition also varies by geographic area, we were concerned that the data for whites and blacks were not comparable. When population-weighted averages of the rates during 1990-1994 for whites using only the five geographic areas with data for blacks were computed, virtually identical rate ratios were revealed for each gender; for males, using all nine SEER areas, the black:white ratio was  $61.2:55.7 = 1.10$  versus  $62.2:57.0 = 1.10$  using the 5 SEER areas, and for females the black:white ratio was  $46.4:38.2 = 1.21$  and  $46.4:38.4 = 1.21$ , respectively.

With improvements in diagnostic techniques, more advanced disease that may have gone unrecognized in the past can now be detected. Unfortunately, we are unable to assess in these data directly the possibility of stage shifts due to improved diagnosis. However, if this were a main factor in our data, in the absence of a true underlying change, rates would increase for distant disease. Yet we observed declines in distant disease over time. If earlier detection has caused a stage shift in these data then any decline in distant disease that we observed is underestimated.

Small case numbers for some of the subsets may have limited our analysis. The standard error (SE) of a rate can be approximated<sup>5</sup> by the equation  $SE(\text{rate}) = \text{rate}/(\text{events})^{1/2}$ . We cited the minimum number of cases in several instances to provide the reader with an idea of the stability of the rates. The consistency of the patterns also should be considered.

Etiologic studies are necessary to understand the marked increase in the incidence of carcinoma of the proximal colon among black males and females. Future epidemiologic studies should explore the associations of potential causal risk factors by disease subsite. In addition, efforts must be made to increase the prevalence of screening for colorectal carcinoma.

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